TII:

Field Effect Transistors

Unclassified

2 Hour Conference, W/ 3Hr PE1

Safety & Environmental Impact is "LOW"

TII: Field Effect Transistors

Terminal Learning Objective

Action: Given a Schematic, Symbols identify the type of FET Correctly and its operational characteristics .

Condition: W/O Reference

Standard: 70% Minimum

TII: Field Effect Transistors

Introduction

Next to the bipolar device that has been studied thus far the Field Effect Transistor is very common in electronic circuitry, though different you will no doubt observe it is similar in many ways.

TII: Field Effect Transistors

FET;

Used;

In Switching Circuits, Amplifiers, & Digital circuits.

Advantages;

1. **High Input Impedance.**
2. **Low Noise Figure**
3. **Operates w/ a small voltage @ the Gate, Controls 100% of the current from Source to Drain. 1 path of conduction.**

Field Effect;

Refers to the Depletion Field formed around the PN junction.

TII: Field Effect Transistors

JFET & MOSFET;

JFET; Junction Field Effect Transistor.

1. **Operates in the <u>Depletion only</u> mode.**
2. **Conducts W/0v on the Gate.**
3. **Reversed Biased for Operation.**

MOSFET; <u>M</u>etal <u>O</u>xide <u>S</u>emiconductor <u>F</u>ield <u>E</u>ffect <u>T</u>ransistor.

1. **Can operate in the <u>Depletion or Enhancement Mode</u>.**
2. **Conducts W/0V on the Gate.**
3. **Reversed or Forward Biased for Operation.**
4. **Also Known as an, IGFET.**

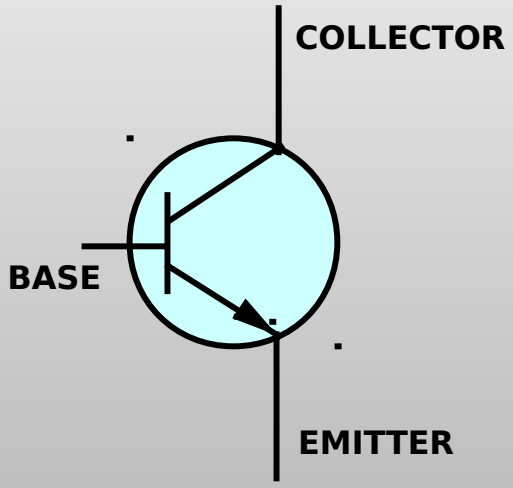
MOSFET, [Enhancement only Mode];

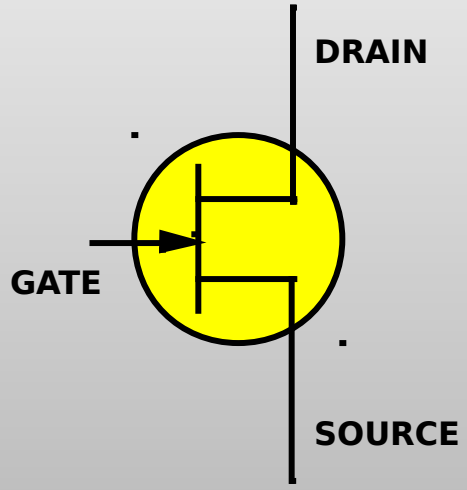
1. **Operates in the enhanced only mode.**
2. **Conducts w/a <u>Positive</u> on the Gate. A channel must be formed to allow for conduction.**
3. **~~Forward Biased for Operation.~~**
4. **Also Known as an, IGFET.**

Bi & Uni-Polar

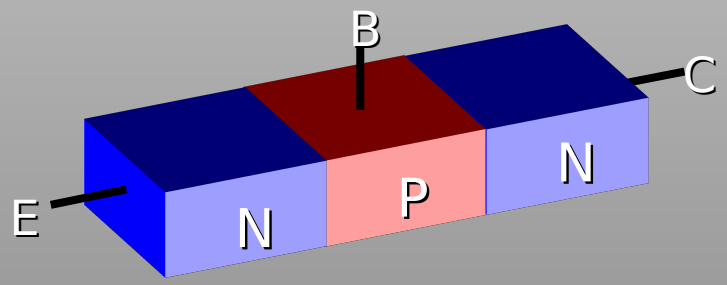
TII: Field Effect Transistors

Bipolar & Unipolar Comparison;

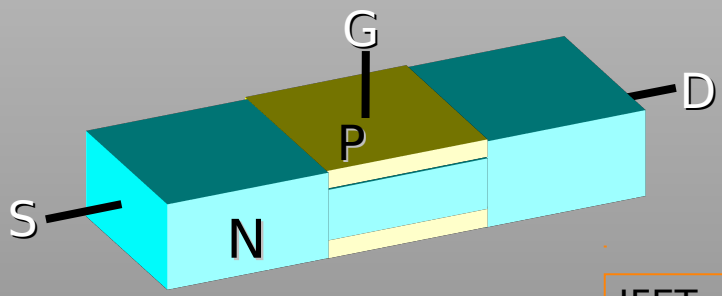




BIPOLAR TRANSISTOR

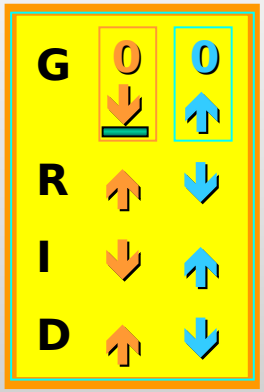


UNIPOLAR TRANSISTOR



JFET Operation

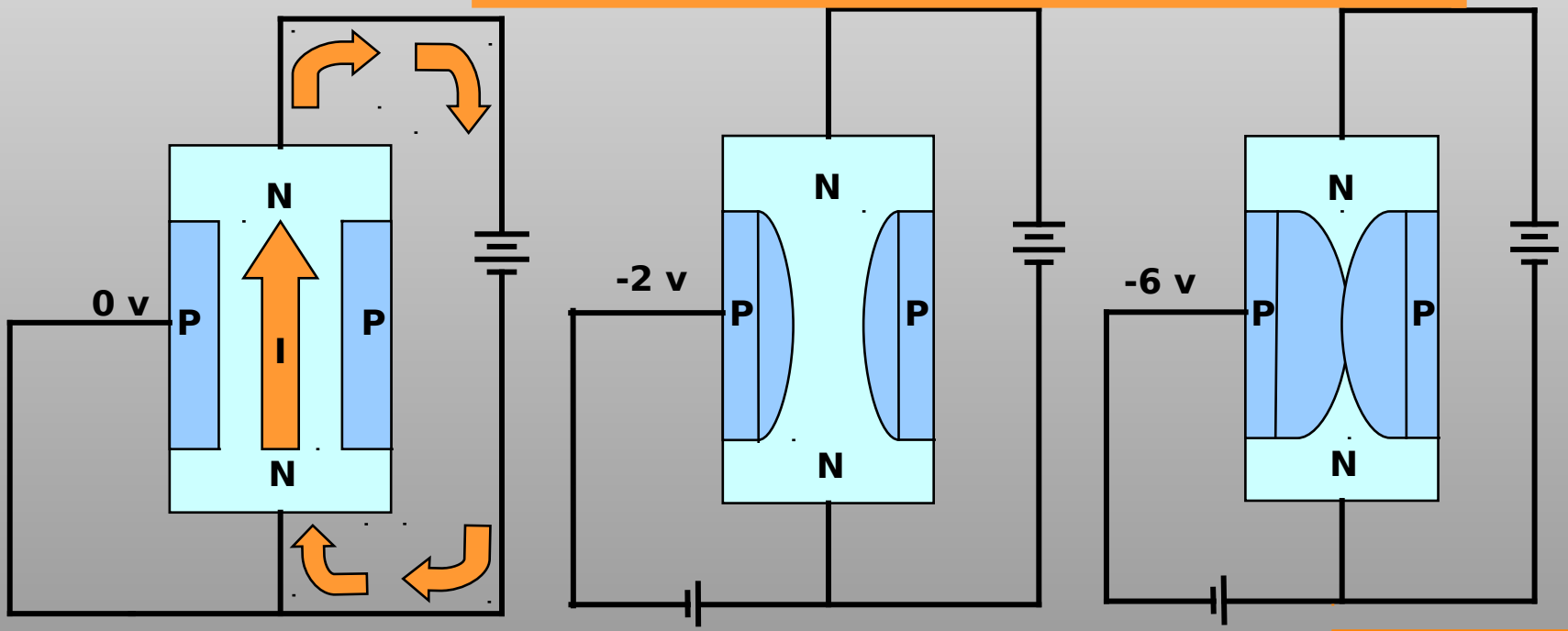
TII: Field Effect Transistors



JFET;

Reverse Bias ↑ or Voltage @ the Gate ↓.

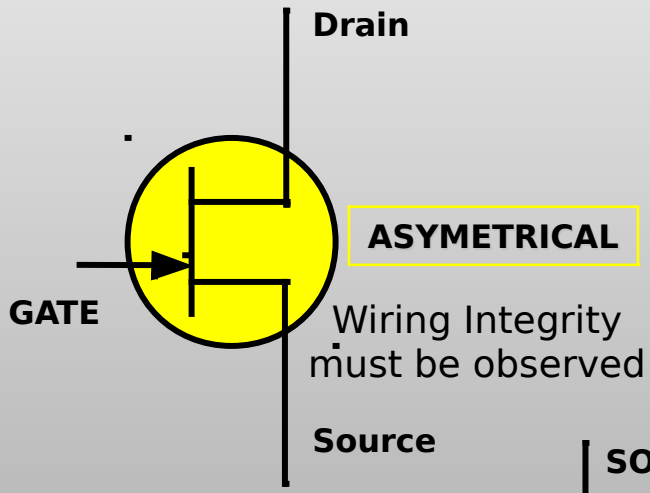
Resistance ↑, Current ↓, E @ the Drain ↑.



Schematic Symbol

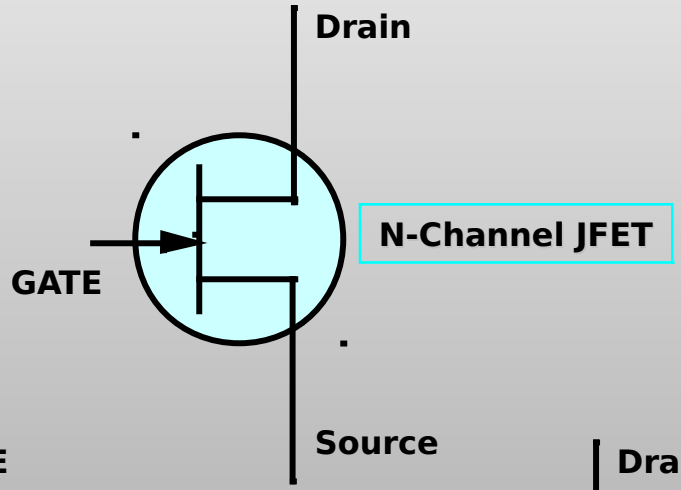
TII: Field Effect Transistors

JFET; Schematic Symbols.

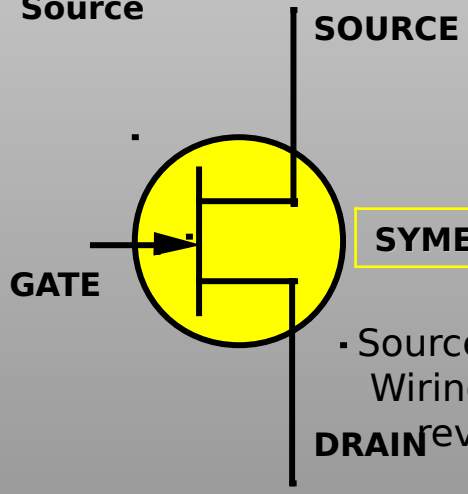


ASYMETRICAL

Wiring Integrity must be observed

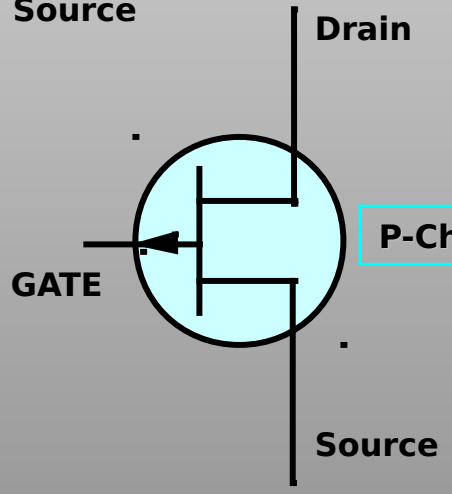


N-Channel JFET



SYMETRICAL

Source & Drain Wiring can be reversed

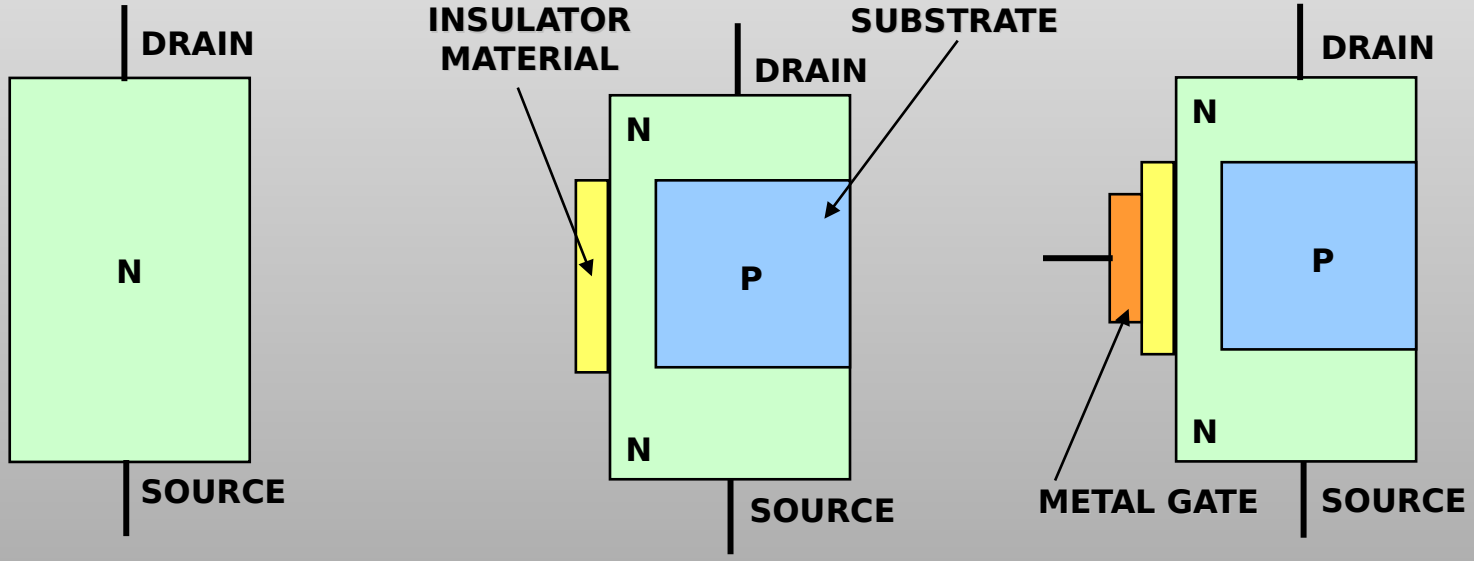


P-Channel JFET

IGFET Construction

TII: Field Effect Transistors

MOSFET, [IGFET]; Construction.



Depletion Mode

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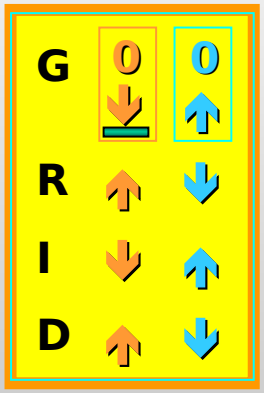
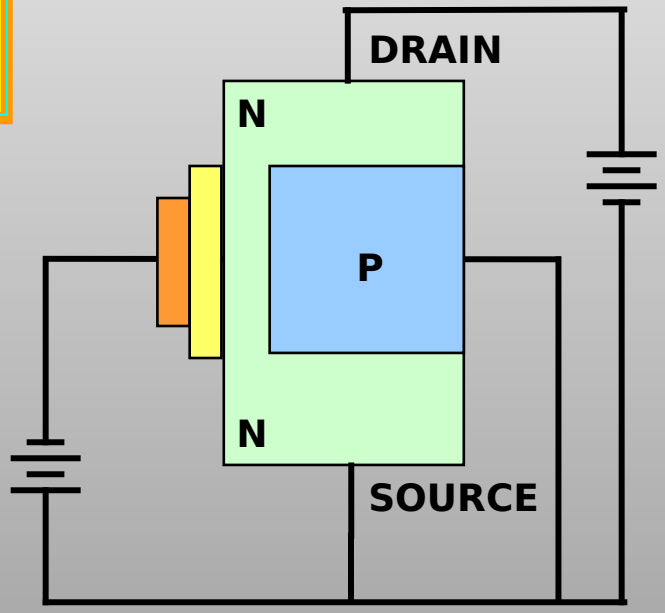
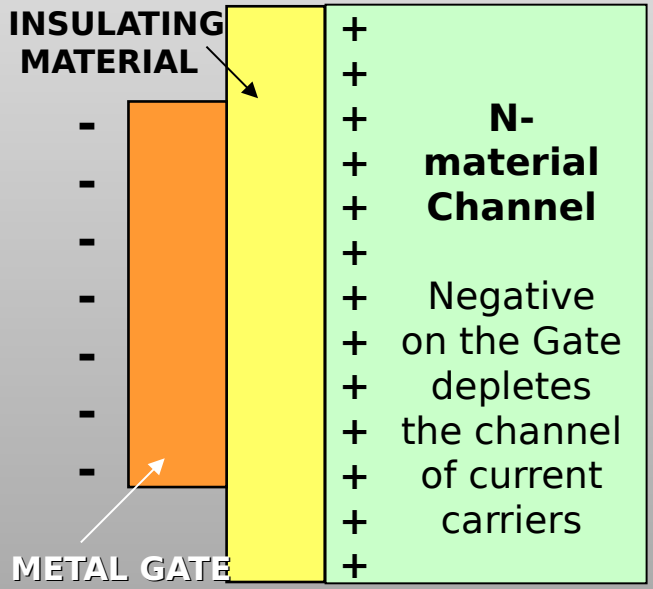


DEPLETION MODE MOSFET; Operation like the JFET.

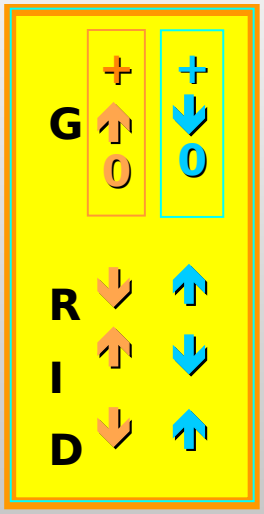


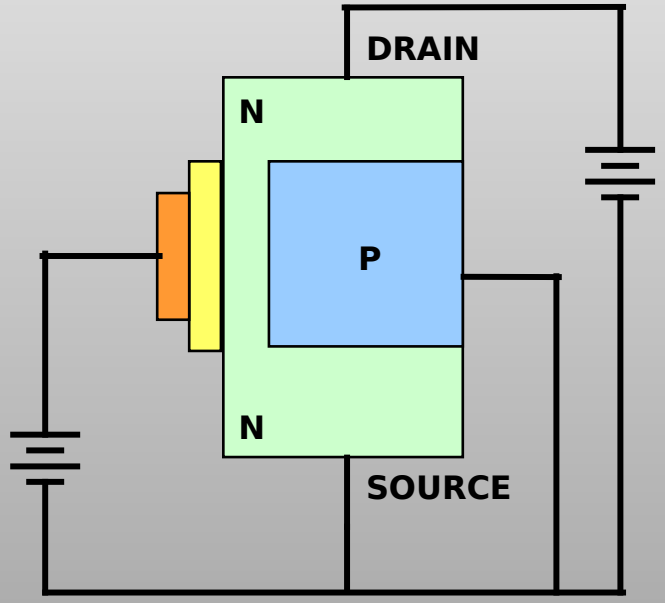


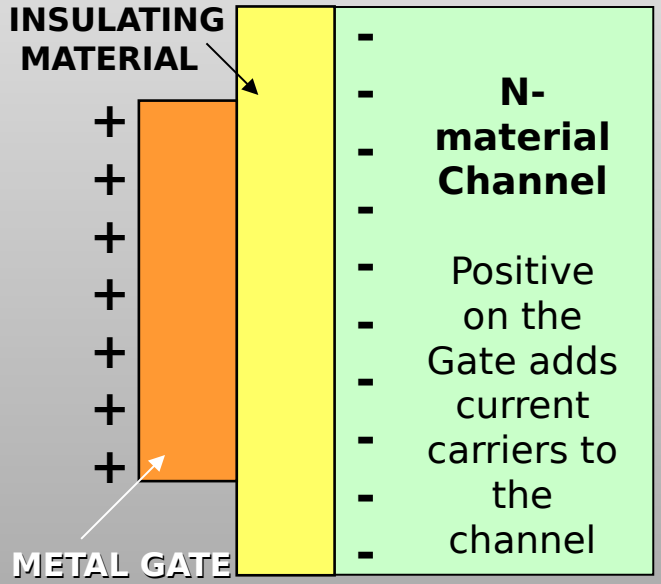
Enhanced Mode

TII: Field Effect Transistors

ENHANCEMENT MODE MOSFET;

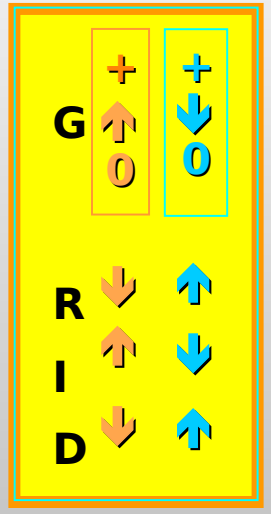




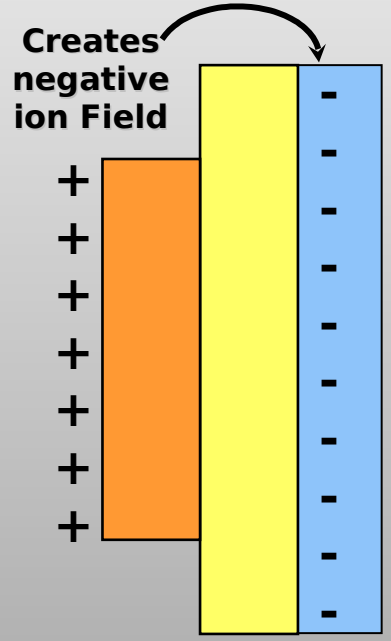


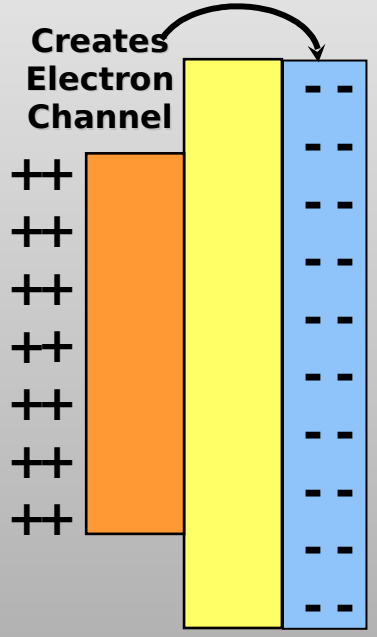
Enhanced only Mode

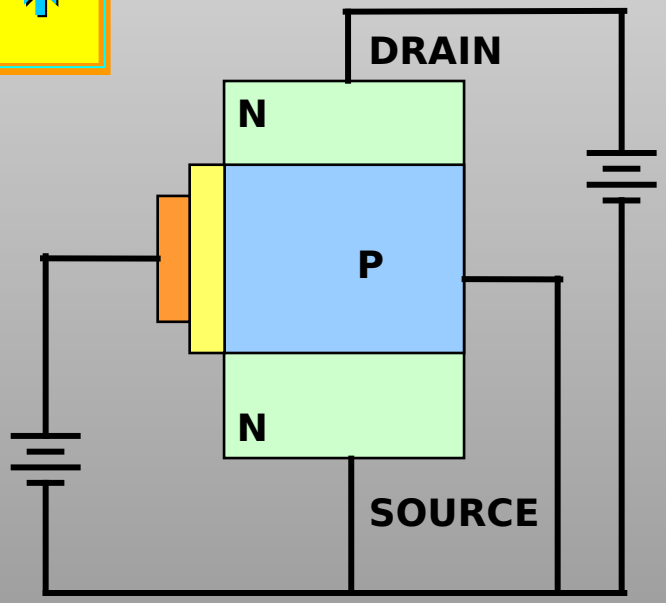
TII: Field Effect Transistors



ENHANCEMENT ONLY MODE MOSFET





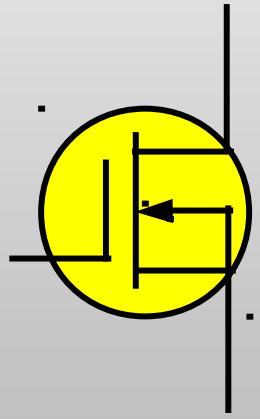


W/ 0V @ the Gate the device is OFF, [no Current flow].

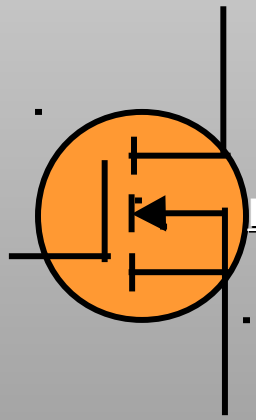
MOFET SCH Symbols

TII: Field Effect Transistors

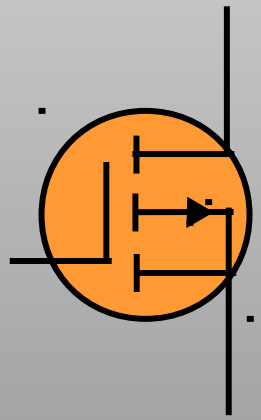
MOSFET Schematic Symbols;



MOSFET Depletion & Enhancement N-channel



MOSFET Enhancement only. N-channel



MOSFET Enhancement only. P-channel

JFET Ckt Comp

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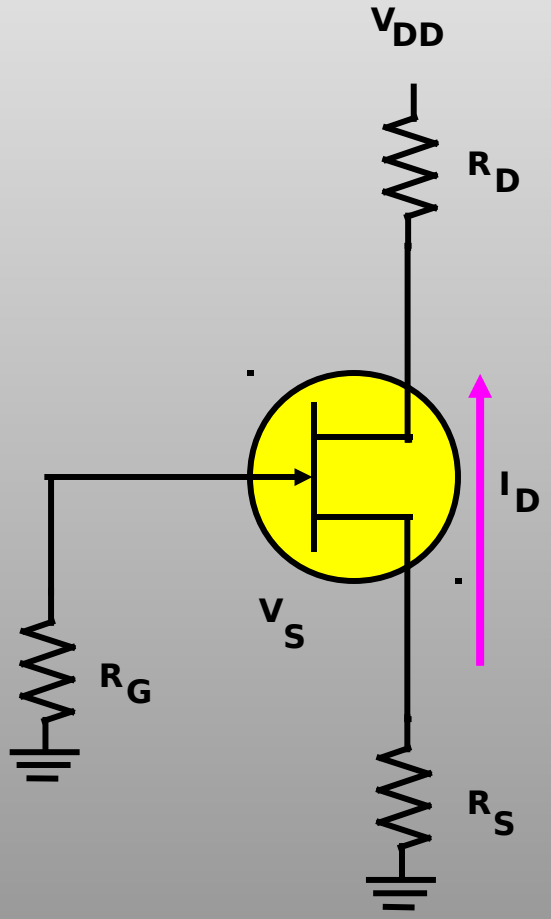
JFET Circuit; Support components;



JFET AMP

TII: Field Effect Transistors

JFET Amplifier; Support Component Identification.

R1 & 2; AC Voltage Divider

R3; Gate-Source Bias, Ensures a very short TC so C1 does not fully charge & 0V on the Gate.

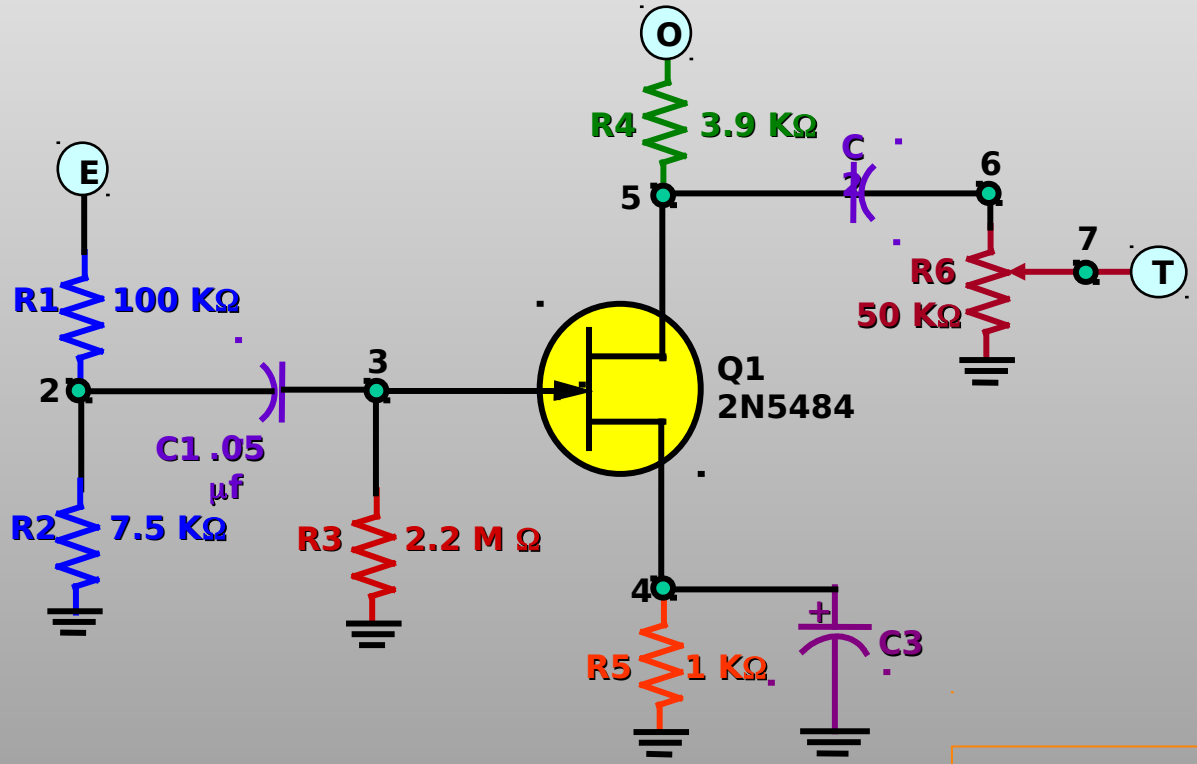
R4; Drain load, Develops the Ckt Gain.

R5; Source - Gate Bias.

C3; Prevents signal degeneration.

C1 & 2; Input & Output Coupling Caps.

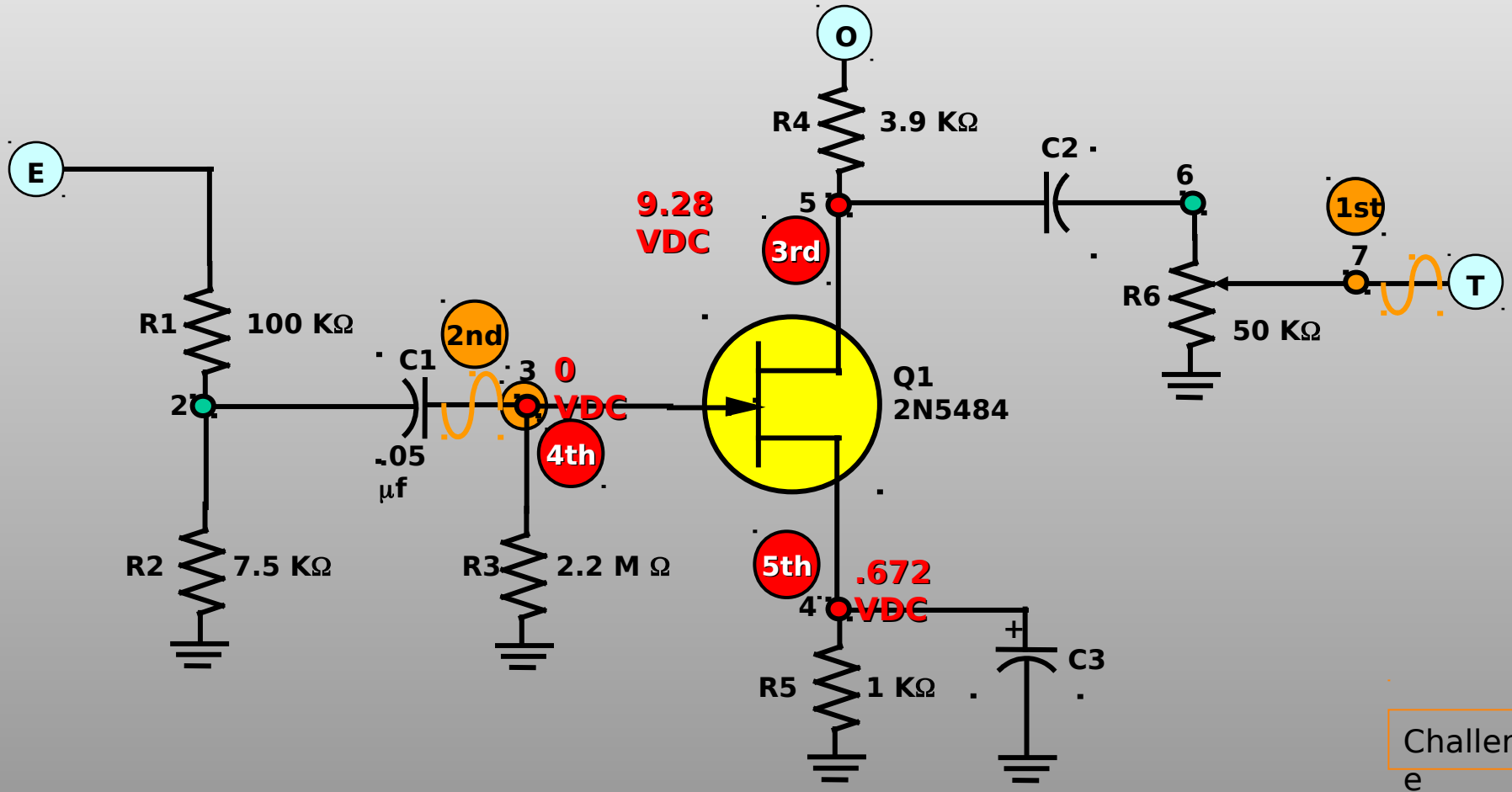
R6; Adjust output Amplitude.



Troubleshooting procedure

TII: Field Effect Transistors

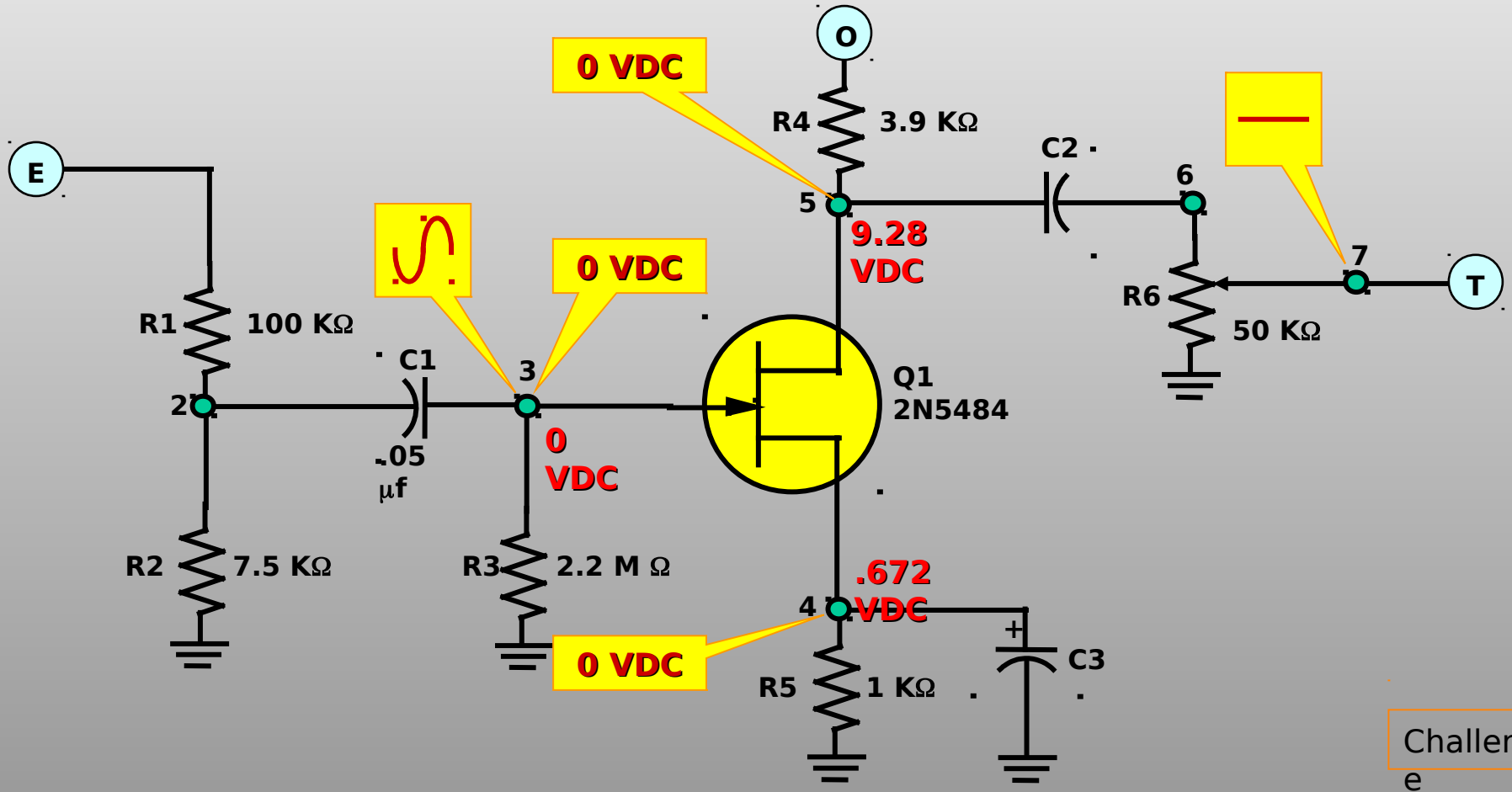
JFET Amplifier; Troubleshooting procedure.



Challenge

TII: Field Effect Transistors

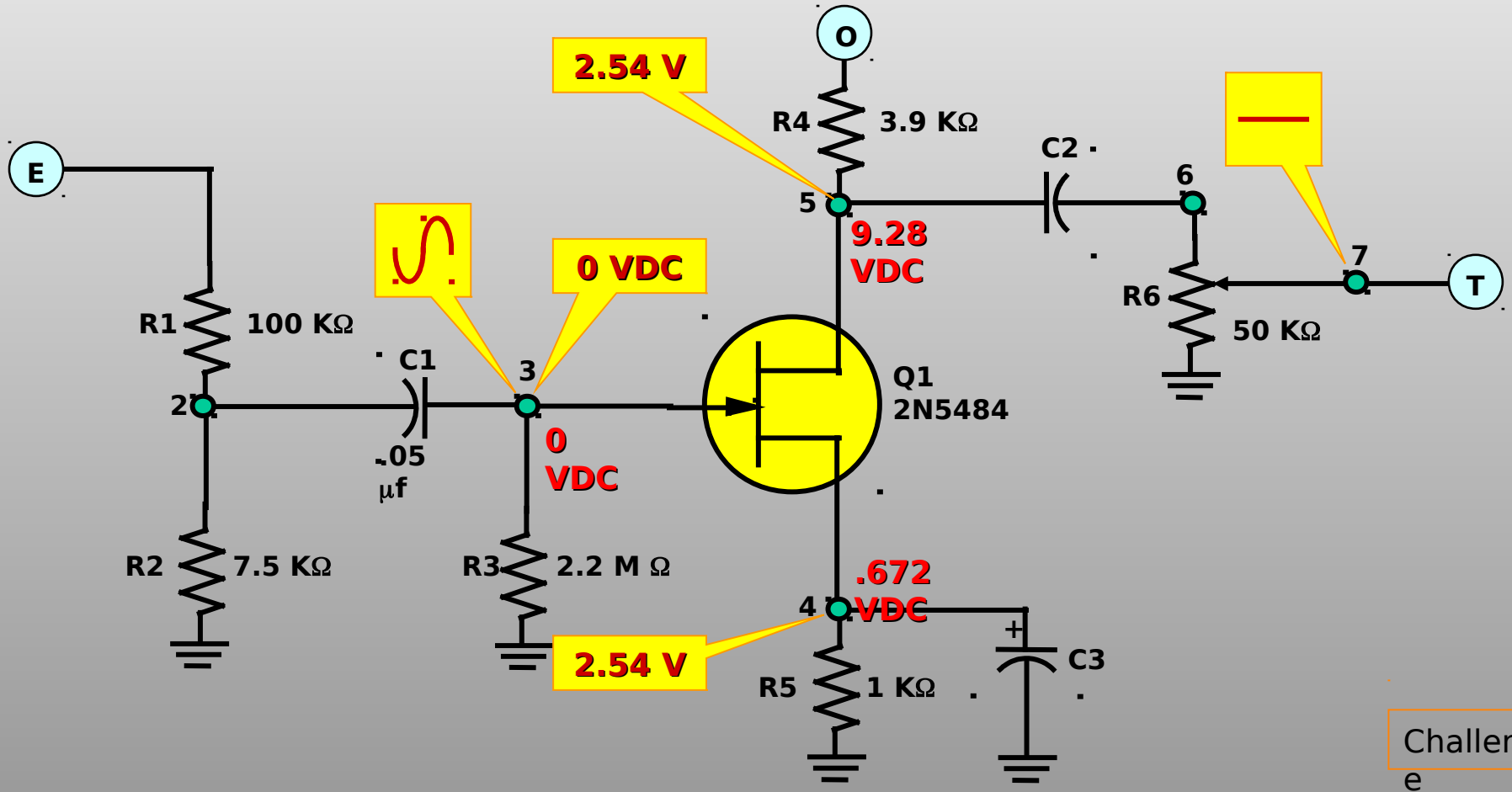
JFET Amplifier; Troubleshooting Challenge #1.



Challenge

TII: Field Effect Transistors

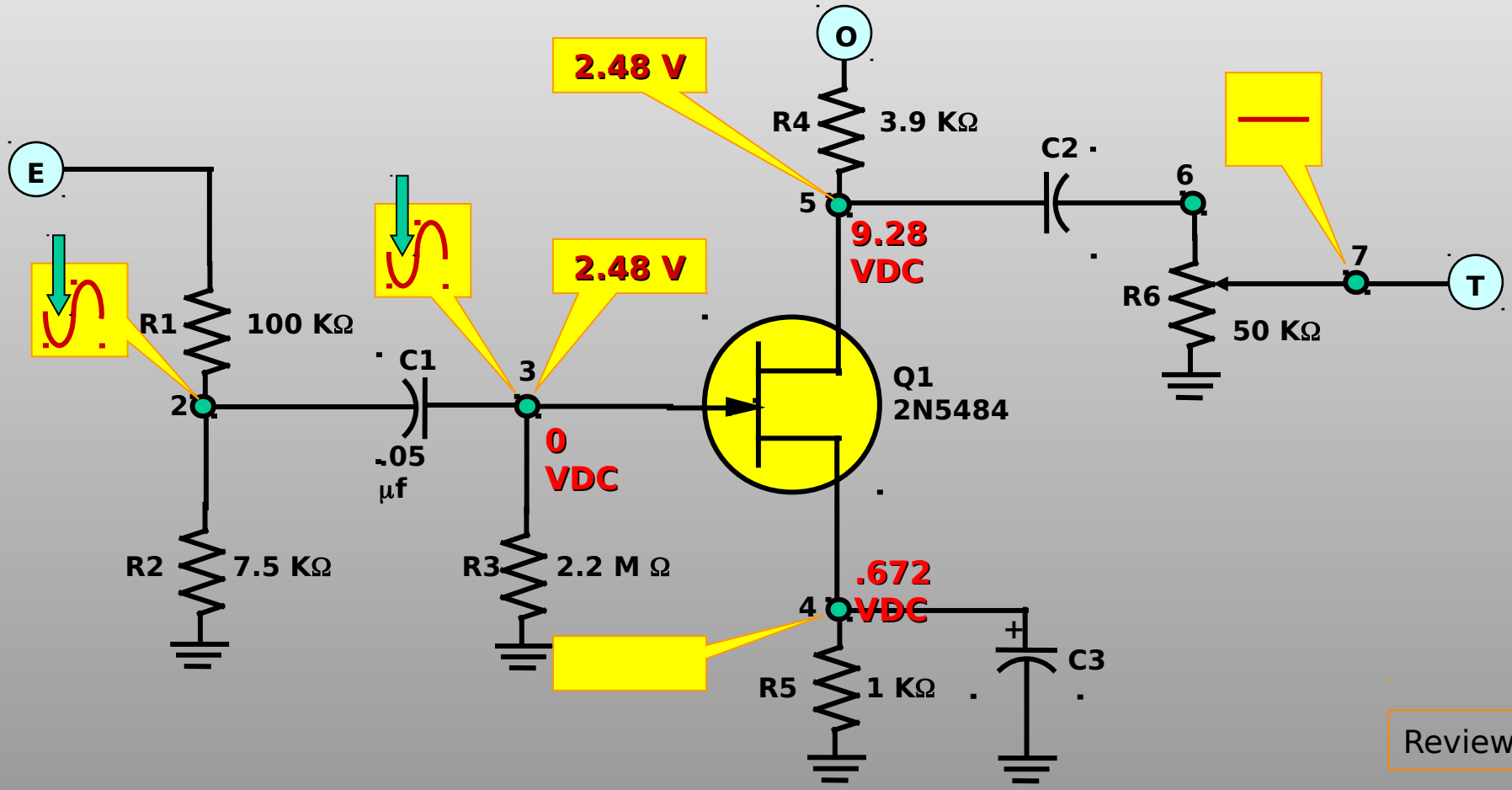
JFET Amplifier; Troubleshooting Challenge #2.



Challenge

TII: Field Effect Transistors

JFET Amplifier; Troubleshooting Challenge #3.



Review ?

TII: Field Effect Transistors

Review Questions;

1. The most significant advantage of the field effect transistor is that no _____ flows from _____ to _____ .
2. The above advantage allows the FET to display the important characteristic of _____ input _____ .
3. All JFETs operate in the _____ mode.
4. What will happen to the current in an N Channel MOSFET when a positive voltage is applied to the Gate ? _____
5. On PC 49 card, what is the phase relationship of Q1 Gate to Drain? ____
6. What condition must be present for a JEFET to operate normally?

   _____
7. What direction does current flow in an FET? _____

Answers

TII: Field Effect Transistors

Review Questions;

8. Which type of FET must have a voltage applied to the Gate to create a channel ? _____
9. The FET is a _____ operated transistor.
10. What value would be measured @ the source if R5 were to open? _____
11. A transistor for which only one Majority current carrier need be considered during normal operation is said to be ___polar.
12. What are the FET terminals called? _____ _____ _____

Answers

TII: Field Effect Transistors

Lesson Test;

Lesson Test:

Standard: 10 Questions W/in 20 Minutes. 70% Minimum Accuracy. Reference: None.

END